

WHAT IS CLAIMED IS:

5 1. A method of delivering electromagnetic radiation onto a tissue to be treated with the electromagnetic radiation, the method comprising the steps of:

(a) providing a lightguide having a polygonal cross-section of a predetermined shape;

(b) directing the radiation into said lightguide; and

10 (c) projecting an image of an exit-face of said lightguide onto the tissue to be treated such that the electromagnetic radiation is delivered onto said tissue in a treatment-spot having the polygonal shape of said lightguide cross section.

15 2. The method of claim 1, further including the step of (d) scanning said projected image such that the electromagnetic radiation is delivered to a region of the tissue having an area to be treated greater than the area of said treatment-spot.

20 3. The method of claim 2, wherein said polygonal shape is selected such that a plurality of said shapes can completely fill said area to be treated essentially without overlapping each other.

4. The method of claim 3, wherein said polygonal shape is one of a rectangle and a hexagon.

25 5. The method of claim 1, wherein said lightguide has a length sufficient that radiation directed therealong has a substantially uniform intensity distribution over said exit-face thereof.

30 6. The method of claim 5, wherein said lightguide length is less than about 50 millimeters.

7. The method of claim 5, wherein, during step (b), said radiation directed into said lightguide emerges from said exit-face thereof as a beam having said substantially uniform energy distribution.

5 8. The method of claim 7, wherein said treatment-spot has a substantially uniform radiation intensity distribution therein.

10 9. The method of claim 8, further comprising the step of (d) during step (c), moving said treatment-spot such that a region of said tissue having an area greater than the area of said treatment-spot receives said radiation, with the intensity of said received radiation being substantially uniform over the region.

15 10. The method of claim 9, wherein said uniformity of radiation intensity in said treatment region is less than about $\pm 20\%$ of a predetermined nominal value.

20 11. A method of delivering electromagnetic radiation onto a region of tissue to be treated with the electromagnetic radiation, the method comprising the steps of:

25 (a) providing an optical system, said optical system including a lightguide having an exit-face, and having a polygonal cross-section of a predetermined shape, said lightguide having a length sufficient that radiation directed therealong has a substantially uniform intensity distribution over said exit-face thereof, said optical system further including a plurality of lenses arranged on an optical axis to project an image of said lightguide exit-face, said projected area having an area less than the area of said area of tissue to be treated;

30 (b) directing the radiation into said lightguide such that a beam of said radiation emerges from said lightguide at said exit-face there, said beam having substantial uniform energy distribution at said exit-face;

(c) projecting said image of said lightguide exit-face and said beam of radiation emerging therefrom onto the tissue to be treated such that the radiation is delivered onto said tissue in a treatment-spot having the polygonal shape of said lightguide cross-section, a substantially uniform energy distribution therein, and an area less than the area of said area of tissue to be treated; and

(d) during step (c) moving said treatment-spot over said region of tissue such that said region of tissue is entirely irradiated with an about uniform intensity distribution of said radiation.

12. The method of claim 11, wherein treatment-spot moving is accomplished by causing relative movement transverse to said optical axis between said exit-face of said lightguide and one or more of said plurality of lenses.

13. The method of claim 11, wherein said treatment-spot moving is accomplished by a galvanometer mirror arrangement located between two of said plurality of lenses.

14. The method of claim 11, wherein said treatment-spot moving is accomplished with said optical system in a fixed location relative to said region of tissue.

15. The method of claim 11, wherein said treatment-spot moving is accomplished by moving said optical system relative to said region of tissue.

16. A method of delivering electromagnetic radiation onto a tissue to be treated with the electromagnetic radiation, the method comprising the steps of:

(a) providing a lightguide having a polygonal cross-section of a predetermined shape;

(b) directing the radiation through said lightguide such that a beam of said radiation emerges from said light guide;

(c) projecting said beam of radiation onto the tissue such that the radiation is delivered to the tissue in a treatment-spot having the shape of the lightguide cross-section.

17. A method of delivering electromagnetic radiation onto a region of tissue to be treated with the electromagnetic radiation, the method comprising the steps of:

(a) providing a lightguide having a polygonal cross-section of a predetermined shape;

(b) directing the radiation through said lightguide such that a beam of said radiation emerges from said lightguide at an exit-face thereof, said emerging beam having a substantially uniform energy distribution at said lightguide exit-face;

(c) projecting said emerging beam of radiation the region of tissue such that the radiation is delivered to the tissue in a treatment-spot having the shape of the lightguide cross-section, and having an area less than area of the region of tissue, said projection is arranged such that said treatment-spot correspondingly has a substantially uniform intensity of irradiation therein; and

(d) during step (c) continuously moving said treatment-spot such that the region of tissue is about uniformly irradiated by the radiation delivered thereto.

18. The method of claim 17, wherein said predetermined shape is rectangular.

19. A method of delivering electromagnetic radiation onto a region of tissue to be treated with the electromagnetic radiation, the method comprising the steps of:

(a) providing a lightguide having a cross-section of a predetermined polygonal shape;

(b) directing the radiation through said lightguide such that a beam of said radiation emerges from said lightguide at an exit-face thereof, said emerging beam having a substantially uniform energy distribution at said lightguide exit-face;

(c) periodically projecting said emerging beam of radiation onto the region of tissue such that the radiation is delivered to the tissue in a sequence of treatment-spots each thereof having the shape of the lightguide cross-section and having an area less than area of the region of tissue, said projection being arranged such that each of said treatment-spots correspondingly has a substantially uniform intensity of irradiation therein;

(d) during step (c) delivering said sequence of spots in a pattern thereof such that the region of tissue is substantially uniformly irradiated by the delivered radiation.

20. Apparatus for delivering electromagnetic radiation onto tissue to be treated therewith, comprising:

a lightguide having a cross-section of a predetermined polygonal shape, said lightguide arranged to receive the radiation to be delivered at an entrance-end thereof and having a length selected such that said received radiation emerges from an exit-face thereof having a substantially uniform intensity distribution at said exit-face; and

a plurality of optical components arranged to project an image of said exit-face of said lightguide onto the tissue to be treated such that the electromagnetic radiation is delivered to a location on said tissue in a treatment-spot having the polygonal shape of said lightguide cross-section, and a substantially uniform intensity of radiation therein.

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20. The apparatus of claim 20, further including a scanning arrangement cooperative with one of said lightguide and said optical system and arranged such that, when the apparatus is held in a fixed spatial relationship with the tissue, the location of the treatment-spot on the tissue can be selectively varied.

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